(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: **0 519 759 B1**

(12) # EUROPEAN PATENT SPECIFICATION

(45) Date of publication of patent specification: **13.12.95**

(51) Int. Cl.[6]: **F16L 37/23**, F16L 37/32

(21) Application number: **92305713.7**

(22) Date of filing: **22.06.92**

(54) **Ouick-action fluid coupling**

(30) Priority: **20.06.91 US 717698**

(43) Date of publication of application:
23.12.92 Bulletin 92/52

(45) Publication of the grant of the patent:
13.12.95 Bulletin 95/50

(84) Designated Contracting States:
AT BE DE FR GB IT LU NL

(56) References cited:
GB-A- 2 068 069
US-A- 2 377 812
US-A- 2 552 543
US-A- 2 690 918
US-A- 3 367 366
US-A- 4 086 939

American national standard ANSI/B93.113M-1987

(73) Proprietor: **PERFECTING SERVICES, INC.**
Post Office Box 30577
Charlotte,
North Carolina 28230-0577 (US)

(72) Inventor: **Mullins, Randall J.**
1235 Hollybank Drive
Matthews,
North Carolina 28105 (US)

(74) Representative: **Murgatroyd, Susan Elizabeth et al**
Baron & Warren
18 South End
Kensington
London W8 5BU (GB)

EP 0 519 759 B1

Description

This invention relates to couplings for quickly joining or separating fluid conducting lines. More particularly, this invention relates to quick-action couplings for use in hydraulic fluid power systems.

Hydraulic fluid power systems are used to operate a variety of machinery. Hydraulic systems transmit and control power for operating machinery by forcing water, oil, or other liquid under pressure through an enclosed circuit of fluid conducting lines. Quick-action couplings are used to quickly join or separate fluid conducting lines without the use of tools or special equipment.

The American National Standards Institute has published standard dimensions and requirements for Hydraulic Fluid Power -- Quick-action Couplings in ANSI/B93.113M-1987. The ANSI Standard sets forth the interface dimensions and specifies basic performance requirements for two series of general-purpose hydraulic quick-action couplings, Series "A" and Series "B". Both series are in widespread use and have similar technological advantages. The International Standards Organization has also published the same standard dimensions and requirements for Series A and Series B couplings under the same title in ISO 7241. Couplings and coupling components made by various manufacturers in accordance with the Standards are interchangeable.

Quick-action couplings made according to the Standards comprise two primary components, or members: a generally cylindrical socket having an axial fluid flow passage that is attached to one hydraulic line and a generally cylindrical plug also having an axial fluid flow passage that is attached to the other. The plug is inserted into the socket to join the two lines and to create a single fluid flow passage between the lines.

Generally speaking, the socket has a plurality of evenly spaced locking balls contained in apertures that form a circle around the plug receiving end of the socket. A spring biased detent sleeve circumscribing the socket holds the locking balls radially inwardly. To insert the plug into the socket, the operator first uses one hand to pull the detent sleeve longitudinally away from the plug receiving end of the socket so that the balls are released. Using the other hand, the operator inserts the plug into the socket. The plug has an annular groove to receive the locking balls. The operator then releases the detent sleeve, which holds the balls in the annular groove in the plug and secures the plug in the socket. The operator removes the plug from the socket in an analogous fashion.

The interchangeable couplings described above have several disadvantages that detract from their usefulness. For example, the operator pulls the sleeve against the bias of a spring so that the plug can be inserted into and withdrawn from the socket. Machinery operators sometimes wear heavy rubber gloves that become oily in use and reduce the dexterity with which the sleeve can be manipulated. The coupling also requires the operator to use both hands to insert the plug into the socket. Using both hands reduces the speed with which the socket and plug can be connected and disconnected.

These disadvantages have caused problems in the operation of rescue equipment that is hydraulically powered, and, in particular, the operation of a rescue tool that is used for extracting victims from automobile wreckage. One such rescue tool is manufactured by Hurst Performance, Inc. under the trademark JAWS OF LIFE®. The JAWS OF LIFE® rescue tool uses two couplings to form a circuit, one in a hydraulic line transferring pressurized fluid from the power source to the tool and one in a return hydraulic line leading from the tool back to the power source. Difficulty has been encountered by the rescue operator in connecting and disconnecting the hydraulic lines at the couplings.

The couplings are generally oriented in different directions and are connected and disconnected one at a time. The rescuer uses both hands to connect each coupling. The rescuer pushes the sleeve longitudinally to release the retaining balls so that the plug can be inserted into the socket and secured and so that the plug can be withdrawn. Frequently, the rescue operator must take off his gloves to connect or disconnect the coupling, consuming even more time in critical moments.

The performance of rescue equipment depends in part upon its compatibility with the power source and in part upon the speed with which the equipment can be used. Coupling components should be manufactured in accordance with ISO 7241 for interchangeability so that the rescue equipment can be used with any available power source without having to change any of the coupling components, either in the hydraulic lines attached to the tool or in the hydraulic lines attached to the power source. The coupling components should also be easily and quickly connected and disconnected by the rescuer.

Snap couplings adapted for assembly and disassembly with one hand have been available in the past, but these couplings are not interchangeable with standard components and are not suitable for use in rescue equipment. For example, U.S. Patent No. Re. 23, 120 to C.E. Earle et al. and U.S. Patent No. 2, 377, 812 to A. T. Scheiwer disclose such snap couplings with the features of the preamble of claim 1. These patents both disclose a spring-biased detent-actuating sleeve carried by a socket. The mating plug engages a detent operator, or

plunger, to bias the sleeve to actuate the detent. As viewed with the socket on the left, the springs are located entirely or at least partially to the right of the ball detents, which requires the socket to have a length to accommodate the spring and requires the plug to have a length to accommodate the distance between the ball detent and the plug receiving end of the socket. Such a coupling is not interchangeable with Standard components made according to ISO 7241, which do not provide the required length in the socket or plug.

It would be desirable to provide interchangeable couplings for use with hydraulically powered rescue equipment such as the JAWS OF LIFE® rescue tool that are easily and quickly connected and disconnected by the rescuer. In particular, it would be desirable to provide a coupling that could be quickly and easily connected and disconnected with one hand while capable of withstanding the rigors of heavy use encountered in rescue operations, and at the same time being interchangeable with standardized components presently in use.

Accordingly, one aspect of the invention consists in a quick-action fluid coupling for fluid conducting lines, with push-to-connect, pull-to-disconnect features, said coupling comprising a generally cylindrical first member having an axial fluid flow passage therethrough, one end of said first member defining a coupling end; a generally cylindrical second member having one end for defining a coupling end that is engageable with said coupling end of said first member for coaxial coupled relation between said first and second members, said second member having a corresponding axial fluid flow passage therethrough so that when said coupling end of said second member is engaged with said coupling end of said first member a single fluid flow passage is defined through said first and second members; at least one detent carried by said first member for securing said second member in coaxial coupled relation with said first member; means on said second member for engaging said detent when said first and second members are engaged in coaxial coupled relation; a collar carried by said first member and longitudinally movable for alternately maintaining said detent in, and releasing said detent from, engagement with said means on said second member; first biasing means for biasing said collar longitudinally toward said coupling end of said first member; a plunger carried by said collar; second biasing means for biasing said plunger longitudinally toward said coupling end of said first member, said plunger being adapted to be engaged by said second member so that when said second member is engaged with said first member in coaxial coupled relation, said second member urges said plunger away from said coupling end of said first member to in turn urge said collar to hold said detent in engagement with said engaging means on said second member, thereby securing said first member and said second member in coaxial coupled relation; whereby said collar is manually movable against said second biasing means to release said detent from said engaging means on said second member so that said second member may be released from coaxial coupled relation with said first member, characterized in that the collar comprises inner and outer sleeves that define an annular channel therebetween, said plunger being longitudinally movable in said channel defined by said inner and outer sleeves of said collar, and pushed into said annular channel when the second member is brought into alignment with the first member.

In a more specific embodiment, the first member is a socket, the second member is a plug, and the detent comprises a plurality of ball detents. The socket has a plurality of apertures for holding the ball detents. The ball detents are movable radially inwardly and outwardly for the insertion of the plug into and removal of the plug from the socket and for coupling engagement of the plug and socket.

The collar carried by the socket may provide a projecting shoulder to hold the balls radially inwardly for coupling engagement with the plug, and an annular groove to release the balls to move radially outwardly from the plug so that the socket and the plug can be disconnected. The collar may be spring biased against the socket so that when the socket and plug are not coupled then the annular groove is brought into registry with the ball retaining apertures and the balls are free to move radially outwardly.

The collar has an inner sleeve and an interlocking outer sleeve that form a channel between them for a spring biased movable plunger. The spring biasing the plunger against the collar may be of relatively greater strength than the spring biasing the collar against the socket. When the plug is inserted into the socket, the plug engages the balls to urge them radially outwardly into the annular groove and to hold the collar in place while the plug also engages the plunger to compress the relatively stronger spring in the channel. On further insertion of the plug into the socket, the balls engage an annular groove on the plug and release the collar. The collar is then biased under the tension of the relatively stronger spring to snap longitudinally away from the plug receiving end of the socket and to bring the projecting shoulder on the inner surface of the collar into register with the ball retaining apertures. The projecting shoulder holds the balls in place in the annular groove on the plug thereby locking the plug and socket in coupling engagement.

To release the plug the operator simply pushes on the collar against the bias of the spring to move the annular groove on the collar in register with the ball retaining apertures to release the balls from the plug and to eject the plug from the socket.

Where two or more hydraulic lines are used simultaneously, then the coupling of the invention can be mounted in a coupling assembly for simultaneous release of the plug of each coupling from its socket.

Accordingly, another aspect of the invention consists in a coupling assembly for connecting and disconnecting two fluid flow lines simultaneously, said coupling assembly comprising two couplings each according to the first aspect of the invention, said coupling assembly further comprising a coupling housing in two mating parts, each part having one of said first members mounted to the housing part for coaxial coupling engagement with the corresponding said second member, the corresponding said second member being mounted in the mating housing part; one of said housing parts further comprising a cam having depending cam lugs and for cammingly engaging said collars; and a pivot shaft connected to said cam for rotating said cam so that said depending cam lugs can engage said collars to move said collars against said second basing means so that said second members can be disconnected from said first members and said housing parts can be separated.

The housing may include a locking means to limit movement of the cam so that the coupling can be disconnected only by unlocking the locking means.

The present invention thus provides a quick-action fluid coupling having push-to-connect, pull-to-disconnect features. The coupling can be installed in a fluid flow line to provide secure coupling under conditions of heavy usage such as is encountered with rescue equipment. Nevertheless, the coupling is easily connected and disconnected during use.

The quick-action fluid coupling has interchangeable components that can be connected and disconnected with one hand and can withstand the rigors of use with rescue equipment. The coupling components of the present invention are fully usable with coupling components presently in use that are manufactured according to the Standards, and do not require the replacement of existing components for compatibility of rescue equipment and power source. The present invention also provides a coupling assembly for connecting and disconnecting two couplings simultaneously, even further decreasing the time required to perform a rescue operation.

The invention will be described by way of example with reference to the accompanying drawings, in which:-

Figure 1 illustrates in partial longitudinal section a representative coupling of the present invention having the plug fully inserted into the socket for coupling engagement.

Figure 2 is a view similar to Figure 1 in which the plug has been released from the socket and is largely withdrawn from the socket.

Figures 3A - 3F illustrate in sequence partial longitudinal sections of the plug of Figure 1 being inserted into the socket of Figure 1 for coupling engagement and then being released and withdrawn from the socket. Figure 3A illustrates the disconnected plug and socket oriented for coupling. Figures 3B and 3C illustrate the plug at various stages of insertion into the socket. Figure 3D illustrates the plug fully inserted into the socket for coupling engagement. Figures 3E and 3F illustrate the plug being released from the socket.

Figure 4 illustrates a top partially broken away and sectional view of a representative embodiment of the present invention for simultaneous connection and disconnection of two of the couplings of the invention.

Figure 5 is a cross-sectional side view of the embodiment of Figure 4 taken along line 5-5 of Figure 4. Portions outside the plane of the section are illustrated in partial section.

Figure 6 illustrates an end cross-sectional view taken along line 6-6 of Figure 4.

Figure 7 illustrates a top cross-sectional view of the embodiment of Figure 5 taken along line 7-7 of Figure 5, with various components out of the plane of the section illustrated in partial section.

Figure 8 illustrates a side cross-sectional view of the embodiment of Figure 4 through Figure 7 with the components separated.

Figure 9 is an elevational view of one of the components of the embodiment of Figure 4 through Figure 8.

Corresponding reference characters indicate corresponding parts throughout the several views of the drawings.

The coupling and coupling assembly of the invention can best be understood with reference to the specific embodiments that are illustrated in the drawings and have been adapted for use in the JAWS OF LIFE® power operated rescue tools. While the invention will be so described, it should be understood that the invention is not intended to be limited to the embodiments illustrated in the drawings, to hydraulically powered rescue equipment, or even to hydraulic fluid power systems. Those of ordinary skill in the art will recognize that hydraulic couplings can be adapted to pneumatic uses with certain modifications. On the contrary, the invention includes all alternatives, modifications,

and equivalents that are included within the scope of the appended claims.

Figure 1 shows a coupling of the present invention broadly designated at **10** having a socket broadly designated at **12** and a mating plug broadly designated at **14** inserted in the socket and connected to the socket in coupled relation. The socket and plug are coupled to form a fluid flow passage **16** between a line **18** that is attached to the socket and another line **20** that is attached to the plug.

The plug and socket are connected in coupled relation by a plurality of ball detents **22** in ball retaining apertures **24** along the circumference of the socket. The ball retaining apertures are tapered toward the flow passage so that the balls are movable radially inwardly to the limit of the taper and are freely moveable radially outwardly with respect to the plug.

The socket includes a counter bore **26** for receiving the mating plug. A seal **28** is carried in the counter bore to engage the plug on insertion of the plug into the socket to substantially prevent fluid leakage from the flow passage when the plug and socket are coupled.

The flow passage of the socket contains a valve **30** that is biased to close the flow passage in the socket when the fittings are disconnected. The valve sits on a stem **32** that is carried by a spider **34**. The spider is fixed in the socket by a snap ring **36**. An O-ring washer **38** around the large diameter portion of the valve **30** engages the side wall **40** of the socket **12** to prevent fluid leakage when the plug is disconnected from the socket. A spring **42** biases the valve and causes the O-ring to engage the sidewall of the socket.

Socket **12** also includes a washer **41** fixed in place against a hexagonal flange **46** for a purpose to be explained later. The washer is held fast against the flange by a snap ring **48**.

The mating plug **14** has a valve **50**, a valve stem **52**, a spider **54**, a snap ring **56**, an O-ring washer **58**, and a spring **60** corresponding, respectively, to the valve, valve stem, spider, snap ring, O-ring washer, and spring of the socket **12** that substantially prevent fluid leakage from the plug when the plug and socket are disconnected.

The valve **50** in the plug cooperates with the valve **30** inthe socket against the bias of springs **42** and **60** to open flow passage **16** when the plug and socket are coupled (Figure 1).

The plug **14** includes a first annular ramp **62** - (shown most clearly in Figures 2 and 3A) that cammingly engages the ball detents **22** and urges them radially outwardly as the plug is inserted into the socket **12**. An annular groove **64** is provided on the plug for receipt of the balls and provides a neck by which the balls can hold the plug in coupled relation with the socket.

The plug also includes a second annular ramp **66** that forms one of the sidewalls of the annular groove **64** (Figure 2) for cammingly engaging the balls and urging them radially outwardly when the plug is removed from the socket. An annular shoulder **68** is also provided on the plug, the purpose of which is explained hereinbelow.

A collar **70** and plunger **72** circumscribe the socket **12** and provide a means for holding the balls **22** in the annular groove **64** of the plug **14** for maintaining the plug and socket in coupled relation and for releasing the balls from the socket and from the plug to disconnect the plug and socket.

The collar **70** has an inner sleeve **74** surrounding the socket. The inner sleeve has a projecting shoulder **76** that is shown in Figure 1 in registry with the ball retaining apertures **24** and holding the balls in engagement with the annular groove **64** in the plug so that the plug and socket are fixed in coaxial coupled relation. Adjacent the projecting shoulder **76**, the inner sleeve has an annular groove **78** for receiving the balls and for engaging the balls to hold the inner sleeve in place while the ramp **62** on the plug urges the balls radially outwardly as the plug is inserted into the socket. The washer **41** on the socket and a flange **80** on the inner sleeve **74** form the end points of a passage **82** between the socket and sleeve. The passage contains a helical compression spring **84** that biases the sleeve against the washer **41** toward the plug receiving end of the socket so that when the plug and socket are disconnected, then the annular groove **78** in the sleeve is held in registry with the ball retaining apertures. The sleeve is limited in further longitudinal movement in the direction of the plug receiving end of the socket by a snap ring **86** that engages the washer **41**.

An outer sleeve **88** surrounds the inner sleeve **74** and engages it in interlocking relationship to form a channel **90** between the inner and outer sleeves. The inner sleeve **74** and the outer sleeve **88** can be press fit, but it is more convenient from a manufacturing standpoint if the inner and outer sleeves are not press fit.

An annular plunger **72** is movable in channel **90** and is biased by a helical compression spring **92** in the channel. Helical compression spring **92** is of relatively greater strength than spring **84**. Movement of the plunger out of the channel is prevented by a snap ring **94**. The spring **92** biases the plunger **72** toward the plug receiving end of the socket **12**. The plunger contains an orifice **96** (Figure 2). The plug **14** is inserted into and withdrawn from the socket **12** through orifice **96**.

Figure 2 shows the coupling **10** of the present invention with the socket **12** and plug **14** disconnected and the plug being withdrawn from the

socket. It can be seen that the spring biased valves **30** and **50** have closed the plug **14** and the socket **12**, respectively. Additionally, the collar **70** has been pushed longitudinally toward the plug receiving end of the socket **12** so that the annular groove **78** in the inner sleeve **80** has been moved into registry with the ball retaining apertures **24**. The ball detents **22** have been released from the annular groove **64** on the plug so that the plug can be ejected from the socket. In Figure 2, the ramps **62** and **66**, the annular groove **64**, and the annular shoulder **68** on the plug can be seen clearly.

Figures 3A through 3F show how the components of the coupling cooperate for connecting the socket and plug in coupling engagement and for releasing the plug from the socket. Figure 3A shows the plug **14** and socket **12** prior to insertion of the plug into the socket. The plunger spring **92** has biased the plunger **72** to the limit of its path of travel toward the plug receiving end of the socket in the channel **90** between the outer sleeve **88** and the inner sleeve **74**. The inner sleeve spring **84** has biased the inner sleeve **74** to the limit of its travel toward the plug receiving end of the socket so that the annular groove **78** on the inner sleeve is in registry with the ball retaining apertures **24**. The ball **22** is shown in a resting position at the limit of the taper of aperture **24**.

Figure 3B illustrates that as the plug is being inserted into the socket the ramp **62** on the plug cammingly engages the balls **22** to urge the balls radially outwardly into engagement with the annular groove **78** on the inner sleeve **74**. At the same time, the annular shoulder **68** on the plug engages the plunger **72** and, as shown in Figure 3C, when the ball is at the uppermost portion of the ramp **62** on the plug, the plug has engaged the plunger **72** to compress spring **92**. The valves **30** and **50** in the socket and plug, respectively, cooperate against the bias of springs **42** and **60** to partially open flow passage **16**. When the plug is pushed further into the socket (Figure 3D), the balls **22** drop into the annular groove **64** on the plug, releasing the inner sleeve **74**. Since spring **92** is stronger than inner sleeve spring **84**, spring **92** urges the inner sleeve **74** longitudinally away from the plug receiving end of the socket so that the projecting shoulder **76** on the inner sleeve engages the ball to hold the ball in the annular groove **64** on the plug. Flow passage **16** is now fully open and the plug and socket are connected in coupled engagement. As shown in Figure 3E, the plug **14** is disconnected from the socket **12** by pushing the collar **70** against the bias of spring **92** so that the annular groove **78** in the inner sleeve **74** comes into registry with the ball retaining apertures **24**. The ramp **66** on the surface of the plug cammingly engages the ball and forces the ball radially outwardly out of the annular groove **64** on the plug and into the annular groove **78** on the inner sleeve to release the ball from the plug.

As shown in Figure 3F, spring **92** and spring biased valves **30** and **50**, which are under tension, are released to disconnect the plug and socket and force the plug out of the socket.

Turning now to a consideration of those embodiments of the invention in which multiple couplings are simultaneously connected and disconnected, Figure 4 shows a coupling assembly in which two couplings broadly designated at **10A** and **10B** are incorporated into a housing **98**. The housing consists of upper and lower parts **100** and **102** in which couplings **10A** and **10B** are mounted. Each housing part has a socket and a plug mounted to receive a corresponding plug and socket mounted in the other housing part.

Socket **12A**, which is mounted in part **100**, receives plug **14A**, which is mounted in part **102**. Socket **12B**, which is mounted in part **102**, receives plug **14B**. As illustrated, coupling **10A** joins socket line **18A** and plug line **20A** for flow in one direction. Coupling **10B** joins socket line **18B** and plug line **20B** for flow in the opposite direction. As those of skill in the art will recognize, fluid flow can be in the same direction in each coupling, if desired, even though the couplings are oriented as shown in Figure 4.

Part **102** of the housing includes a rotatable mechanism for disconnecting the sockets and plugs and allowing the portions of the housing to be separated. A pivot shaft **103** and rotatable handle **104**, biased by a spring **106** that is contained within a cap **108** to return to its inoperative position, engages a cam **110** having depending cam lugs **112** and **114** (see Figure 5). When rotated, the handle and shaft rotate the cam and causes cam lug **112** to engage outer sleeve **88A** and cam lug **114** to engage outer sleeve **88B** simultaneously. On further rotation of the handle, the cam lugs urge the collars against the bias of the springs to simultaneously disconnect the sockets and plugs as previously described with reference to Figure 2 and Figures 3E through 3F.

After the sockets and plugs have been disconnected, the handle is released and spring **106** biases the handle and cam to return to an inoperative position. A stop pin **116** engages the cam to limit the rotation of the cam and handle under the bias of the spring in a manner that is described hereinbelow.

A key **118** is used to prevent inadvertent rotation of the handle and disconnection of the sockets and plugs except when desired. The key has a larger diameter portion **120** that is biased by a spring **122** to engage the cam to prevent its rotation. The operator depresses a button portion **124** of the key that extends to the exterior of the

housing part **102** so that the key no longer engages the cam, and the cam can be rotated to disconnect the sockets and plugs.

Turning now to other representative views of the two coupling assembly, Figure 5 illustrates a side view cross-section of a housing taken along line 5-5 of Figure 4 and showing coupling **10A** with the plug and socket connected in coupling engagement and in partial cross section. The side walls of housing parts **100** and **102** are shown in substantially triangular, interlocking configuration and engaged along a diagonal.

Figure 6 illustrates in a partial section a view of the housing of Figure 4 taken along line 6-6 of Figure 4. Taken together, Figures 4, 5, and 6 show the orientation of the key **118** in the housing with respect to the cam and couplings.

Figure 7 illustrates a top cross-sectional view of the housing taken along line 7-7 of Figure 5. Key **118** is depressed and the handle **104** and cam **110** are turned so that cam lug **112** engages plunger sleeve **88A** and cam lug **114** engages plunger sleeve **88B**. The plunger sleeves are shown having been moved toward the plug receiving end of the sockets so that the annular grooves **78A** and **78B** in the inner sleeves are in register with the ball retaining apertures **24A** and **24B**. The balls are released and the plugs can be disconnected.

Figure 8 is a view similar to Figure 5, but showing the two halves of the housing disconnected and the plugs and sockets are substantially as shown in Figure 3A.

Figure 9 illustrates the handle **104**, the cap **108**, the cam **110**, the depending cam lugs **112** and **114**, and the stop pin **116**. As illustrated, the cam is shown having a larger diameter portion and a smaller diameter portion providing a notch for engaging the cam stop pin **116**. The cam stop pin **116** engages the notch to limit the rotational movement of the cam when the handle **104** is released and is biased by the spring **106** to return to the position that the handle and cam occupy when the sockets and plugs are connected.

When used in connection with the operation of the JAWS OF LIFE® power operated rescue tools, the assembly illustrated in Figures 4-9 provides a hydraulic flow line to the tool and a return line. Even while wearing heavy gloves and under the time constraints of emergency procedures followed in a rescue operation to extract a victim from automobile wreckage, the rescue operator can quickly and easily depress key **118** and rotate the handle **104** to disconnect the sockets and plugs of couplings **10A** and **10B** and to separate housing part **100** from housing portion **102**. The coupling can just as easily be reconnected by the same operator simply by pushing the two housing parts together. Additionally, the construction provides a sturdy coupling having a protected plunger element that is not easily damaged and provides a secure connection.

While the coupling of the invention has been described with respect to its use in the JAWS OF LIFE® power operated rescue tools, those of ordinary skill of the art will recognize that the coupling can be used for a variety of fluid flow applications and is easily adaptable for either gas or liquid fluid flow applications. For example, a number of sockets and plugs can be mounted in fixed positions and can be simultaneously connected and disconnected quickly and easily by using the coupling of this invention.

The present invention has been described with specific reference to preferred embodiments. However, variations can be made within the scope of the appended claims.

Claims

1. A quick-action fluid coupling (10) for fluid conducting lines, with push-to-connect, pull-to-disconnect features, said coupling comprising a generally cylindrical first member (12) having an axial fluid flow passage therethrough, one end of said first member defining a coupling end; a generally cylindrical second member (14) having one end for defining a coupling end that is engageable with said coupling end of said first member for coaxial coupled relation between said first and second members, said second member having a corresponding axial fluid flow passage therethrough so that when said coupling end of said second member is engaged with said coupling end of said first member a single fluid flow passage (16) is defined through said first and second members; at least one detent (22) carried by said first member (12) for securing said second member (14) in coaxial coupled relation with said first member (12); means (64) on said second member (14) for engaging said detent (22) when said first and second members are engaged in coaxial coupled relation; a collar (70) carried by said first member (12) and longitudinally movable for alternately maintaining said detent (22) in, and releasing said detent from, engagement with said means (64) on said second member (12); first biasing means (84) for biasing said collar longitudinally toward said coupling end of said first member; a plunger (72) carried by said collar (70); second basing means (92) for basing said plunger (72) longitudinally toward said coupling end of said first member (12), said plunger (72) being adapted to be engaged by said second member (14) so that when said second member

(14) is engaged with said first member (12) in coaxial coupled relation, said second member (14) urges said plunger (72) away from said coupling end of said first member to in turn urge said collar (70) to hold said detent (22) in engagement with said engaging means (64) on said second member (14), thereby securing said first member and said second member in coaxial coupled relation; whereby said collar (70) is manually movable against said second biasing means (92) to release said detent (22) from said engaging means on said second member (14) so that said second member (14) may be released from coaxial coupled relation with said first member, characterized in that the collar (70) comprises inner and outer sleeves (74) and (88) that define an annular channel (90) therebetween, said plunger (72) being longitudinally movable in said channel defined by said inner and outer sleeves of said collar, and pushed into said annular channel (90) when the second member (14) is brought into alignment with the first member (12).

2. The coupling as claimed in claim 1, wherein said first member is a socket (12) and said second member is a plug (14).

3. The coupling as claimed in claim 2, wherein said plug (14) and said socket (12) further comprise valves (50) and (30), and means for biasing said valves for stopping flow through said axial flow passages when said socket and plug are not in coaxial coupled engagement, said valve means cooperating to define said single flow passage (16) through said socket and plug when in coaxial coupled engagement, and said valve means further cooperating to urge said plug out of said socket when said plug is released from said socket.

4. The coupling as claimed in claim 1, 2, or 3, wherein said first member is a socket (12) and said second member is a mating plug (14), the coupling end of said socket (12) defining a plug receiving end, and said at least one detent comprises a plurality of ball detents (22) retained in retaining apertures (24) defined by said socket.

5. The coupling as claimed in claim 4, wherein said inner sleeve (74) further comprises an annular projecting shoulder (76) for engaging said ball detents (22) to hold said ball detents (22) in engagement with said engaging means (64) on said plug (14) for coaxial coupled relation of said plug (14) and said socket (12); and an annular groove (78) adjacent said projecting shoulder (76) on the side of said projecting shoulder (76) opposite said plug receiving end of said socket for engaging said ball detents (22) upon receipt of said plug in said socket so that the annular collar (70) is secured by said detents (22), said first and second helical compression springs (84) and (92), are compressed, and when said engaging means (64) on said mating plug (14) comes into register with said ball retaining apertures (24), then said annular collar (70) snaps said projecting shoulder (76) into registry with said ball retaining apertures (24) to hold said plug and socket in coaxial coupled relation, said annular groove (78) also providing for releasing said ball detents from engagement with said means (64) on said plug and withdrawing said plug from coaxial coupled relation with said socket.

6. The coupling as claimed in any preceding claim, wherein the inner and outer sleeves (74) and (88) of said collar (12) comprise separate interlocking sleeves (74) and (88).

7. The coupling as claimed in any preceding claim, wherein said first socket and said inner sleeve define an annular passage (82) therebetween for said first biasing means, said first biasing means is a relatively weaker spring (84), and said second basing means is a relatively stronger spring (92).

8. The coupling as claimed in claim 7, wherein said relatively weaker spring and said relatively stronger spring comprise helical compression springs (84) and (92) that are confined on the side of said detent opposite said coupling end of said first member (12).

9. The coupling as claimed in claims 4 and 7, wherein said relatively weaker spring and said relatively stronger spring comprise helical compression springs (84) and (92) that are confined on the side of said ball detents (22) opposite said plug receiving end of said socket (12).

10. The coupling as claimed in any preceding claim, wherein said coupling comprises seals (28) for hydraulic fluids.

11. The coupling as claimed in any preceding claim, wherein said collar and said plunger each include stop means (86) and (94) for limiting their movement in one direction.

12. A coupling assembly for connecting and disconnecting two fluid lines simultaneously, said

coupling assembly comprising two couplings (10A) and (10B) each as claimed in any preceding claim, said coupling assembly further comprising a coupling housing in two mating parts (101) and (102), each part having one of said first members (12) mounted to the housing part for coaxial coupling engagement with the corresponding said second member (14), the corresponding said second member being mounted in the mating housing part; one of said housing parts further comprising a cam (110) having depending cam lugs (112) and (114) for cammingly engaging said collars; and a pivot shaft (103) connected to said cam (110) for rotating said cam so that said depending cam lugs can engage said collars to move said collars against said second basing means so that said second members can be disconnected from said first members and said housing parts can be separated.

13. The coupling assembly as claimed in claim 12, wherein said first member is a socket and said second member is a plug, and wherein said at least one detent comprises a plurality of ball detents retained in ball retaining apertures defined by said socket for securing said mating plug in coaxial coupled relation with said socket, said coupling assembly further comprising a locking means for preventing said cam from being rotated, said locking means (116) being movable to a position in which said cam is free to rotate.

Patentansprüche

1. Schnellkupplung (10) für Strömungsmittelleitungen, die bei Druckaufbringung gekuppelt und bei Zugaufbringung entkuppelt wird, mit einem allgemein zylindrischen ersten Element (12) mit einem sich durch diesen erstreckenden axialen Strömungsmittelkanal, wobei ein Ende des ersten Elementes ein Kupplungsende bildet, einem allgemein zylindrischen zweiten Element (14) mit einem Ende zur Ausbildung eines Kupplungsendes, das mit dem Kupplungsende des ersten Elementes in Eingriff bringbar ist, um eine koaxiale gekuppelte Beziehung zwischen dem ersten und zweiten Element herzustellen, wobei das zweite Element einen entsprechenden, durch diesen hindurch erstreckenden axialen Strömungsmittelkanal aufweist, so daß beim in Eingriffbringen des Kupplungsendes des zweiten Elementes mit dem Kupplungsende des ersten Elementes ein einziger Strömungsmittelkanal (16) durch das erste und zweite Element hindurch gebildet wird, mindestens einem Anschlag (22), der vom ersten Element (12) getragen wird, um das zweite Element (14) in koaxialer gekuppelter Beziehung mit dem ersten Element (12) zu halten, Einrichtungen (64) am zweiten Element (14) zum in Eingrifftreten mit dem Anschlag (22), wenn das erste und zweite Element miteinander in koaxialer gekuppelter Beziehung stehen, einer Manschette (70), die vom ersten Element (12) getragen wird und in Längsrichtung bewegbar ist, um abwechselnd den Anschlag (22) in Eingriff mit den Einrichtungen (64) am zweiten Element (12) zu halten und den Anschlag aus diesem Eingriff freizugeben, ersten Vorspanneinrichtungen (84) zum Vorspannen der Manschette in Längsrichtung gegen das Kupplungsende des ersten Elementes, einem von der Manschette (70) getragenen Kolben (72), zweiten Vorspanneinrichtungen (92) zum Vorspannen des Kolbens (72) in Längsrichtung gegen das Kupplungsende des ersten Elementes (12), wobei der Kolben (72) derart mit dem zweiten Element (14) in Eingriff treten kann, daS bei einem Eingriff des zweiten Elementes (14) mit dem ersten Element (12) in koaxialer gekuppelter Beziehung das zweite Element (14) den Kolben (72) vom Kupplungsende des ersten Elementes wegdrückt, um die Manschette (70) so unter Druck zu setzen, daß sie den Anschlag (22) in Eingriff mit den Eingriffseinrichtungen (64) am zweiten Element (14) hält und auf diese Weise das erste Element und das zweite Element in koaxialer gekuppelter Beziehung hält, wobei die Manschette (70) manuell gegen die zweiten Vorspanneinrichtungen (92) bewegbar ist, um den Anschlag (22) von den Eingriffseinrichtungen am zweiten Element (14) freizugeben, und wobei das zweite Element (14) aus der koaxialen gekuppelten Beziehung mit dem ersten Element freigegeben werden kann, dadurch gekennzeichnet, daß die Manschette (70) eine innere und ein äußere Hülse (74 und 88) umfaßt, die dazwischen einen Ringkanal (90) bilden, und daS der Kolben (72) in dem von der inneren und äußeren Hülse der Manschette gebildeten Kanal in Längsrichtung bewegbar ist und in den Ringkanal (90) gedrückt wird, wenn das zweite Element (14) mit dem ersten Element (12) in Ausrichtung gebracht wird.

2. Kupplung nach Anspruch 1, bei der das erste Element eine Muffe (12) und das zweite Element ein Rohrstutzen (14) ist.

3. Kupplung nach Anspruch 2, bei der der Rohrstutzen (14) und die Muffe (12) des weiteren Ventile (50 und 30) und Einrichtungen zum Vorspannen der Ventile zum Stoppen eines

Durchflusses durch die axialen Strömungskanäle umfassen, wenn sich die Muffe und der Rohrstutzen nicht in koaxialem gekuppelten Eingriff befinden, wobei die Ventileinrichtungen zusammenwirken und den einzigen Strömungskanal (16) durch die Muffe und den Rohrstutzen bilden, wenn sie sich in koaxialem gekuppelten Eingriff befinden, und wobei die Ventileinrichtungen des weiteren zusammenwirken, um den Rohrstutzen aus der Muffe herauszudrücken, wenn der Stutzen von der Muffe gelöst wird.

4. Kupplung nach Anspruch 1, 2 oder 3, bei der das erste Element eine Muffe (12) und das zweite Element ein passender Rohrstutzen (14) ist, das Kupplungsende der Muffe (12) ein Aufnahmeende für den Rohrstutzen bildet und der mindestens eine Anschlag eine Vielzahl von Kugelanschlägen (22) umfaßt, die in Halteöffnungen (24) gehalten sind, welche von der Muffe gebildet werden.

5. Kupplung nach Anspruch 4, bei der die innere Hülse (74) des weiteren eine ringförmige vorstehende Schulter (76) für den Eingriff mit den Kugelanschlägen (22) aufweist, um die Kugelanschläge (22) in Eingriff mit den Eingriffseinrichtungen (64) am Rohrstutzen (14) zu halten, um eine koaxiale gekuppelte Beziehung zwischen dem Rohrstutzen (14) und der Muffe (12) herzustellen, und eine Ringnut (78) benachbart zur vorstehenden Schulter (76) auf der Seite der vorstehenden Schulter (76) gegenüber dem Aufnahmeende der Muffe für den Rohrstutzen, um bei Aufnahme des Rohrstutzens in der Muffe mit den Kugelanschlägen (22) in Eingriff zu treten, so daß die ringförmige Manschette (70) durch die Anschläge (22) gehalten wird, wobei eine erste und zweite Schraubendruckfeder (84 und 92) zusammengepreßt werden, wobei dann, wenn die Eingriffseinrichtungen (64) am passenden Rohrstutzen (14) mit den Kugelhalteöffnungen (64) in Übereinstimmung kommen, die ringförmige Manschette (70) die vorstehende Schulter (76) in Übereinstimmung mit den Kugelhalteöffnungen (24) schnappt, um den Rohrstutzen und die Muffe in koaxialer gekuppelter Beziehung zu halten, wobei ferner die Ringnut (78) für ein Lösen der Kugelanschläge aus dem Eingriff mit den Einrichtungen (64) am Rohrstutzen und für ein Zurückziehen des Rohrstutzens aus der koaxialen gekuppelten Beziehung mit der Muffe sorgt.

6. Kupplung nach einem der vorangehenden Ansprüche, bei der die innere und äußere Hülse (74, 88) der Manschette (12) separate Verriegelungshülsen (74, 88) umfassen.

7. Kupplung nach einem der vorangehenden Ansprüche, bei der die erste Muffe und die innere Hülse einen Ringkanal (82) dazwischen für die ersten Vorspanneinrichtungen bilden, wobei die ersten Vorspanneinrichtungen durch eine relativ schwache Feder (84) und die zweiten Vorspanneinrichtungen durch eine relativ stärkere Feder (92) gebildet werden.

8. Kupplung nach Anspruch 7, bei der die relativ schwache Feder und die relativ stärkere Feder Schraubendruckfedern (84, 92) umfassen, die auf der Seite des Anschlages, die dem Kupplungsende des ersten Elementes (12) gegenüberliegt, begrenzt sind.

9. Kupplung nach den Ansprüchen 4 und 7, bei der die relativ schwache Feder und die relativ stärkere Feder Schraubendruckfedern (84, 92) umfassen, die auf der Seite der Kugelanschläge (22), die dem Rohrstutzenaufnahmeende der Muffe (12) gegenüberliegt, begrenzt sind.

10. Kupplung nach einem der vorangehenden Ansprüche, bei der die Kupplung Dichtungen (28) für Hydraulikmittel aufweist.

11. Kupplung nach einem der vorangehenden Ansprüche, bei der die Manschette und der Kolben jeweils Anschlageinrichtungen (86, 94) zum Begrenzen ihrer Bewegung in einer Richtung besitzen.

12. Kupplungseinheit zum gleichzeitigen Verbinden und Trennen von zwei Strömungsmittelleitungen mit zwei Kupplungen (10A und 10B) nach einem der vorangehenden Ansprüche und mit einem Kupplungsgehäuse in zwei Paßteilen (101 und 102), wobei jeder Teil eines der ersten Elemente (12) aufweist, das am Gehäuseteil montiert ist, um einen koaxialen Kupplungseingriff mit dem entsprechenden zweiten Element (14) zu erreichen, wobei das entsprechende zweite Element im passenden Gehäuseteil montiert ist und einer der Gehäuseteile des weiteren einen Nocken (110) mit herabhängenden Nockennasen (112) und 114) für einen Nockeneingriff mit den Manschetten aufweist und wobei eine Welle (103) mit dem Nocken (110) verbunden ist, um diesen zu drehen, so daß die herabhängenden Nockennasen mit den Manschetten in Eingriff treten können, und die Manschetten gegen die zweiten Vorspanneinrichtungen zu bewegen, so daß die zweiten Elemente von den ersten Ele-

menten und die Gehäuseteile voneinander getrennt werden können.

13. Kupplungseinheit nach Anspruch 12, bei der das erste Element eine Muffe und das zweite Element ein Rohrstutzen ist und bei der der mindestens eine Anschlag eine Vielzahl von Kugelanschlägen umfaßt, die in Kugelhalteöffnungen gehalten werden, welche von der Muffe gebildet werden, um den passenden Rohrstutzen in koaxialer gekuppelter Beziehung mit der Muffe zu halten, und wobei die Kupplungseinheit des weiteren eine Verriegelungseinrichtung (116) zur Verhinderung einer Drehung des Nockens umfaßt, welche in eine Position bewegbar ist, in der sich der Nocken frei drehen kann.

Revendications

1. Raccord (10) pour fluides, à action rapide, pour des conduites transportant des fluides, pouvant être connecté par poussée et déconnecté par traction, ce raccord comprenant un premier organe (12) généralement cylindrique, lequel est traversé par un passage axial pour l'écoulement des fluides, une extrémité dudit premier organe définissant une extrémité de couplage ; un deuxième organe (14), généralement cylindrique, comportant une extrémité pour définir une extrémité de couplage pouvant entrer en prise avec ladite extrémité de couplage dudit premier organe, pour assurer une relation de couplage coaxial entre ledit premier et ledit deuxième organes, ledit deuxième organe étant traversé par un passage axial correspondant, pour l'écoulement des fluides, de sorte que, quand ladite extrémité de couplage dudit deuxième organe est en prise avec ladite extrémité de couplage dudit premier organe, un passage unique (16) pour l'écoulement des fluides est défini, par ledit premier et ledit deuxième organes ; au moins un arrêt (22), porté par ledit premier organe (12) pour fixer ledit deuxième organe (14) en relation de couplage axial avec ledit premier organe (12) ; un moyen (64), sur ledit deuxième organe (14), pour entrer en prise avec ledit arrêt (22) quand ledit premier et ledit deuxième organes sont en prise l'un avec l'autre selon une relation de couplage axial ; un collier (70), porté par ledit premier organe (12) et pouvant subir un déplacement longitudinal pour alternativement maintenir ledit arrêt (22) en prise avec ledit moyen (64) se trouvant sur ledit deuxième organe (12), et en dégager ledit arrêt ; un premier moyen d'orientation (84), pour orienter ledit collier longitudinalement vers ladite extrémité de couplage dudit premier organe ; un piston (72) porté par ledit collier (70) ; un deuxième moyen d'orientation (92) pour orienter ledit piston (72) longitudinalement vers ladite extrémité de couplage dudit premier organe (12), ledit piston (72) étant adapté de façon à ce que ledit deuxième organe (14) entre en prise avec lui, de telle sorte que, quand ledit deuxième organe (14) est en prise avec ledit premier organe (12) selon une relation de couplage axial, ledit deuxième organe (14) pousse ledit plongeur (72) en l'éloignant de ladite extrémité de couplage dudit premier organe, pour ensuite pousser ledit collier (70) de façon qu'il maintienne ledit arrêt (22) en prise avec ledit moyen de prise (64) sur ledit deuxième organe (14), ce qui fixe ledit premier organe et ledit deuxième organe selon une relation de couplage coaxial ; où ledit collier (70) peut être déplacé à la main contre ledit deuxième moyen d'orientation (92) pour dégager ledit arrêt (22) dudit moyen de prise se trouvant sur le deuxième organe (14), de façon que ledit deuxième organe (14) puisse être dégagé de la relation de couplage coaxial avec ledit premier organe, caractérisé en ce que le collier (70) comprend des manchons intérieurs (74) et extérieur (88) qui définissent entre eux un canal annulaire (90), ledit piston (72) pouvant subir un déplacement longitudinal dans ledit canal défini par lesdits manchons intérieur et extérieur dudit collier, et étant poussé dans ledit canal annulaire (90) quand le deuxième organe (14) est mis en alignement avec le premier organe (12).

2. Raccord selon la revendication 1, dans lequel ledit premier organe est une douille (12), et ledit deuxième organe est une fiche mâle (14).

3. Raccord selon la revendication 2, dans lequel ladite fiche (14) et ladite douille (12) comprennent en outre des vannes (50) et (30), et un moyen pour orienter lesdites vannes dans le but d'interrompre l'écoulement à travers lesdits passages axiaux d'écoulement quand ladite douille et ladite fiche ne sont pas en prise en couplage coaxial, lesdits moyens de vanne coopérant pour définir ledit passage unique d'écoulement (16) à travers lesdites douille et fiche quand elles sont en prise en couplage coaxial, et lesdits moyens de vanne coopérant en outre pour pousser ladite fiche en l'extrayant de ladite douille quand ladite fiche est dégagée de ladite douille.

4. Raccord selon la revendication 1, 2 ou 3, dans lequel le premier organe est une douille (12) et

le deuxième organe est une fiche de raccordement (14), l'extrémité de couplage de la douille (12) définissant une extrémité réceptrice de fiche, et ledit au moins un arrêt comprend une pluralité d'arrêts à rotule (22), retenus dans les ouvertures de retenue (24) définies par la douille.

5. Raccord selon la revendication 4, dans lequel ledit manchon intérieur (74) comprend en outre un épaulement en saillie annulaire (76) destiné à entrer en prise avec lesdits arrêts à rotule (22) pour maintenir lesdits arrêts à rotule (22) en prise avec ledit moyen de prise (64) se trouvant sur ladite fiche (14) pour assurer une relation de couplage coaxial de ladite fiche (14) et de ladite douille (12) ; une gorge annulaire (78) contiguë audit épaulement en saillie (76) sur le côté dudit épaulement en saillie (76) opposé à ladite extrémité réceptrice de fiche de ladite douille, pour entrer en prise avec lesdits arrêts à rotule (22) après que ladite fiche a été reçue dans ladite douille, de façon que le collier annulaire (70) soit fixé par lesdits arrêts (22), lesdits premier et deuxième ressorts de compression hélicoïdaux (84) et (92) étant comprimés, et, quand ledit moyen de prise (64) se trouvant sur ladite fiche de raccordement (14) entre en registre avec lesdites ouvertures de retenue de rotule (24), alors ledit collier annulaire (70) met ledit épaulement en saillie (76) en registre avec lesdites ouvertures de retenue de rotule (24) pour maintenir ladite fiche et ladite douille selon une relation de couplage coaxial, ladite gorge annulaire (78) permettant aussi auxdits arrêts à rotule de se dégager dudit moyen (64) se trouvant sur la fiche, et de supprimer la relation de couplage axial entre ladite fiche et ladite douille.

6. Raccord selon l'une quelconque des revendications précédentes, dans lequel les manchons intérieur et extérieur (74) et (88) dudit collier (12) comprennent des manchons distincts (74) et (78) à verrouillage réciproque.

7. Raccord selon l'une quelconque des revendications précédentes, dans lequel la première douille et le premier manchon intérieur définissent un passage annulaire (82) entre eux pour ledit premier moyen d'orientation, ledit premier moyen d'orientation est un ressort relativement faible (84), et ledit deuxième moyen d'orientation est un ressort relativement fort (92).

8. Raccord selon la revendication 7, dans lequel ledit ressort relativement faible et ledit ressort relativement fort comprennent des ressorts de compression hélicoïdaux (84) et (92) qui sont confinés sur le côté dudit arrêt opposé à ladite extrémité de couplage dudit premier organe (12).

9. Raccord selon les revendications 4 et 7, dans lequel ledit ressort relativement faible et ledit ressort relativement fort comprennent des ressorts de compression hélicoïdaux (84) et (92), qui sont confinés sur le côté desdits arrêts à rotule (22) opposé à ladite extrémité réceptrice de fiche de ladite douille (12).

10. Raccord selon l'une quelconque des revendications précédentes, dans lequel ledit raccord comprend des joints (28) pour fluides hydrauliques.

11. Raccord selon l'une quelconque des revendications précédentes, dans lequel ledit collier et ledit piston comprennent chacun des moyens d'arrêt (86) et (94) pour limiter leur déplacement dans une direction.

12. Ensemble d'accouplement pour connecter et déconnecter simultanément deux conduites transportant des fluides, ledit ensemble d'accouplement comprenant deux raccords (10A) et (10B), chacun selon l'une quelconque des revendications précédentes, ledit ensemble d'accouplement comprenant en outre une enveloppe d'accouplement, en deux parties correspondantes (101) et (102), chaque partie ayant l'un de ses premiers organes (12) monte sur la partie enveloppe pour une prise en couplage coaxial avec ledit deuxième organe correspondant (14), ledit deuxième organe correspondant étant monté dans la partie d'enveloppe correspondante ; l'une desdites parties d'enveloppe comprenant en outre une came (110), qui possède des talons de came dépendants (112) et (114), pour permettre une prise des colliers par l'intermédiaire de cames ; et un boulon d'articulation (103), connecté à ladite came (110), pour faire tourner ladite came de façon que lesdits talons de came dépendants puissent entrer en prise avec lesdits colliers pour déplacer lesdits colliers contre ledit deuxième moyen d'orientation, de façon que lesdits deuxièmes organes puissent être déconnectés desdits premiers organes, et que l'on puisse séparer lesdites parties d'enveloppe.

13. Ensemble d'accouplement selon la revendication 12, dans lequel ledit premier organe est une douille et ledit deuxième organe est une fiche, et dans lequel ledit au moins un arrêt

comprend une pluralité d'arrêts à rotule retenus dans des ouvertures de retenue de rotule définis par ladite douille, pour fixer ladite fiche de raccordement selon une relation en couplage coaxial avec ladite douille, ledit ensemble d'accouplement comprenant en outre un moyen de verrouillage pour empêcher une rotation de ladite came, ledit moyen de verrouillage (116) pouvant se déplacer jusqu'à une position dans laquelle ladite came peut subir librement une rotation.

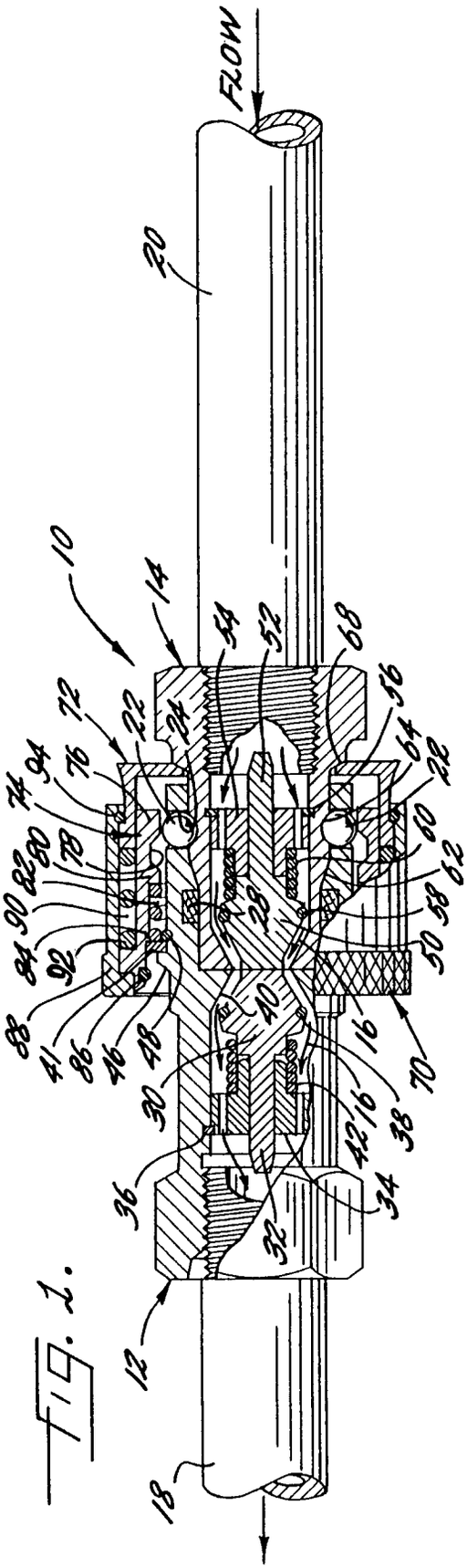
FLOW
20
10
14
54
52
68
72
22
24
56
64
74
94
76
60
62
78
80
82
90
84
92
58
50
88
41
86
46
48
40
30
16
70
42
38
36
34
32
12
18

Fig. 1.

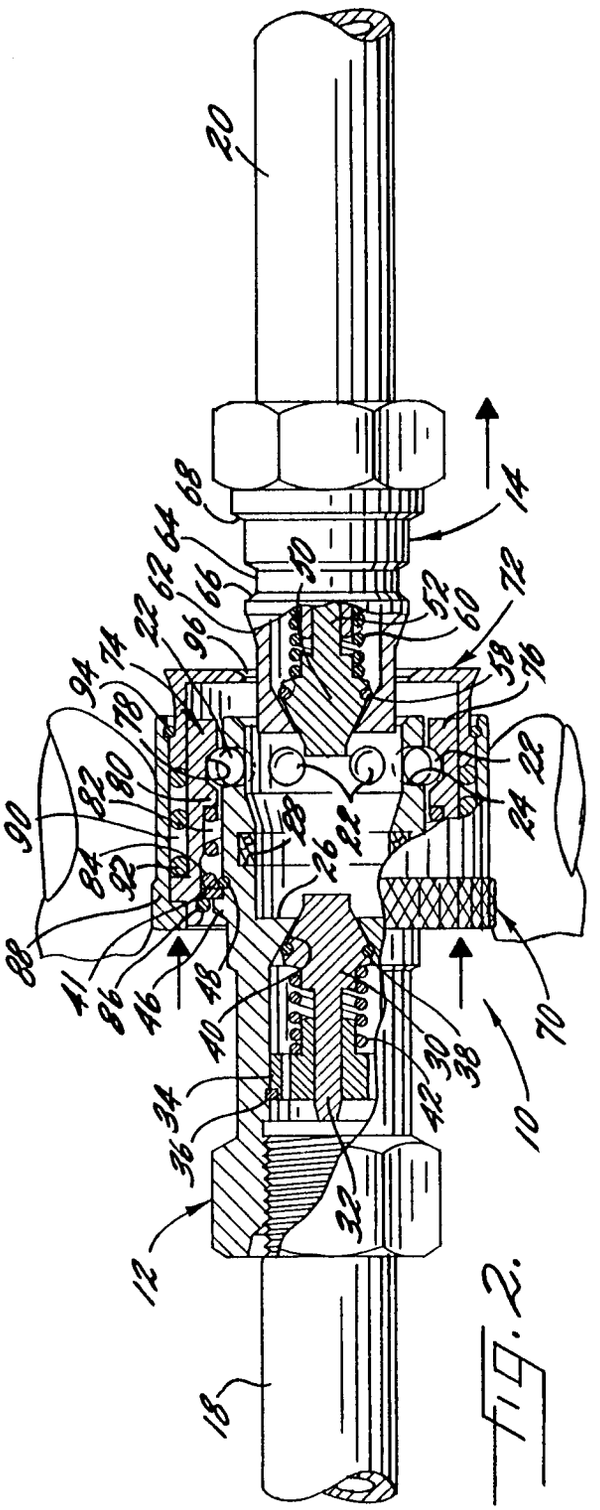
20
14
68
64
62
66
10
22
96
52
60
72
94
74
58
76
78
80
82
90
84
92
88
41
86
46
48
40
30
38
70
34
36
42
32
12
18
10

Fig. 2.

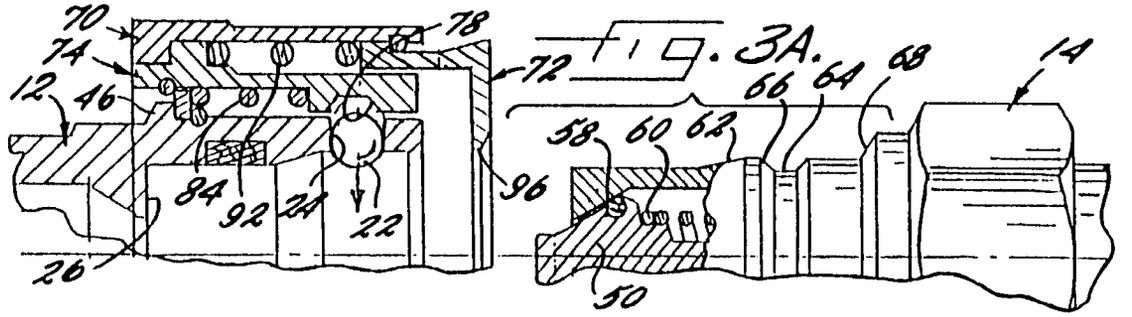

Fig. 3A.

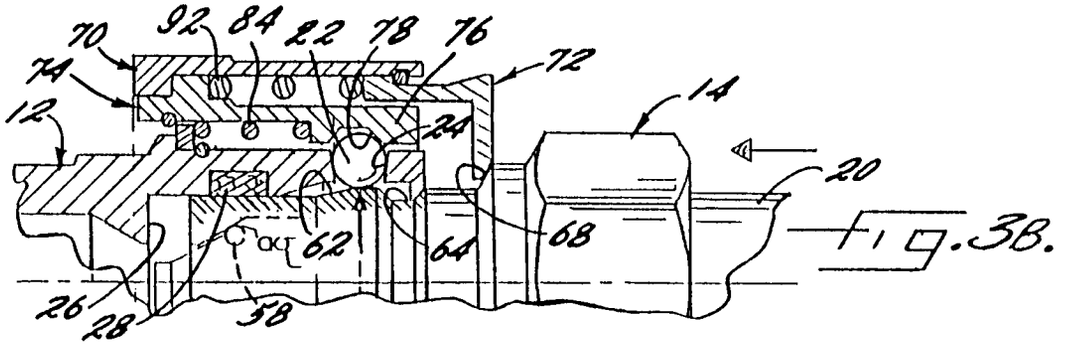

Fig. 3B.

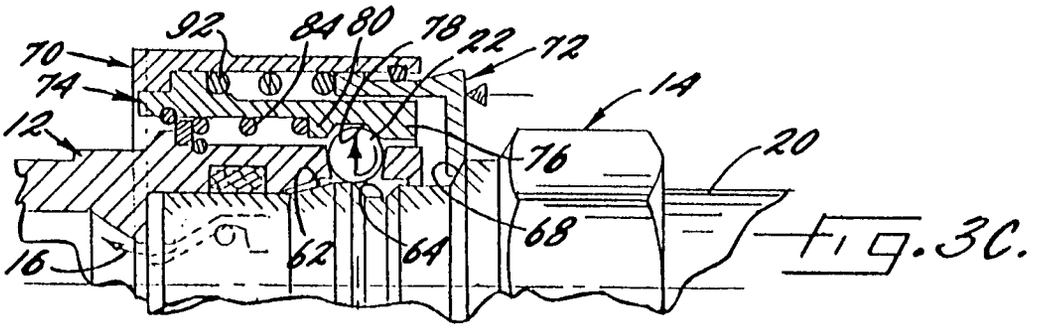

Fig. 3C.

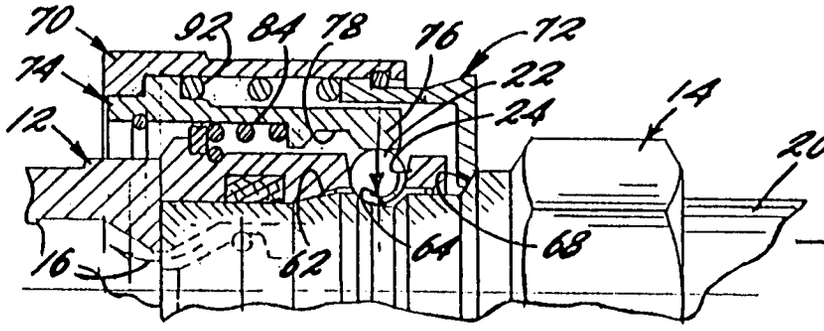

FIG. 3D.

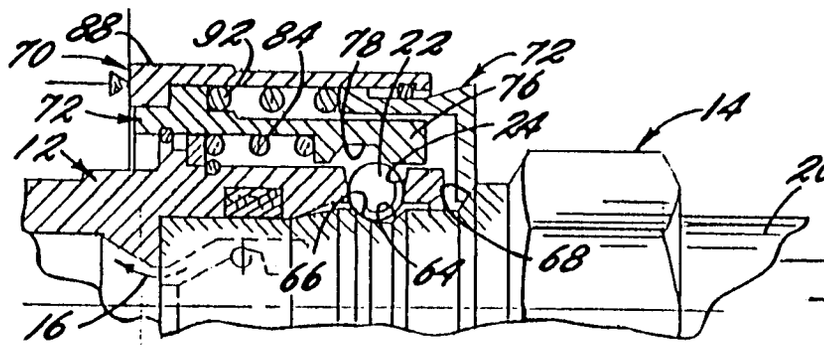

FIG. 3E.

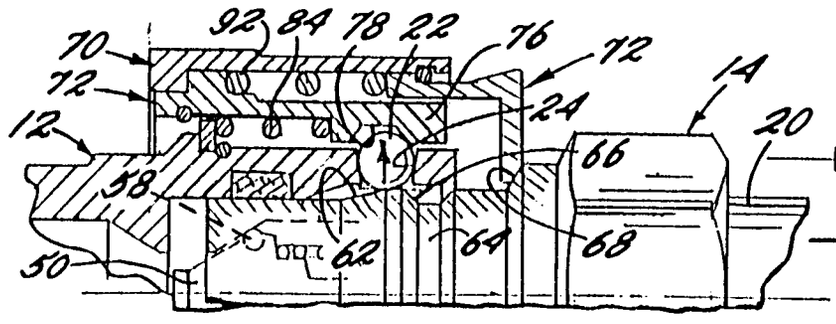

FIG. 3F.

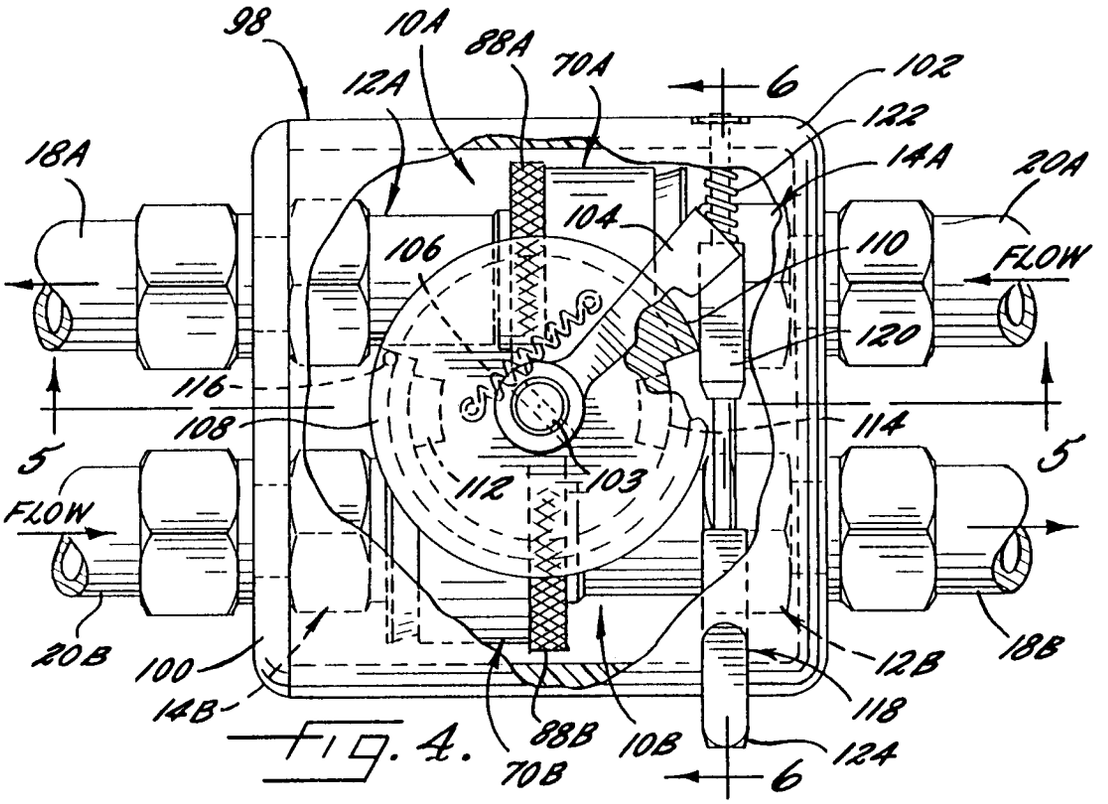

Fig. 4.

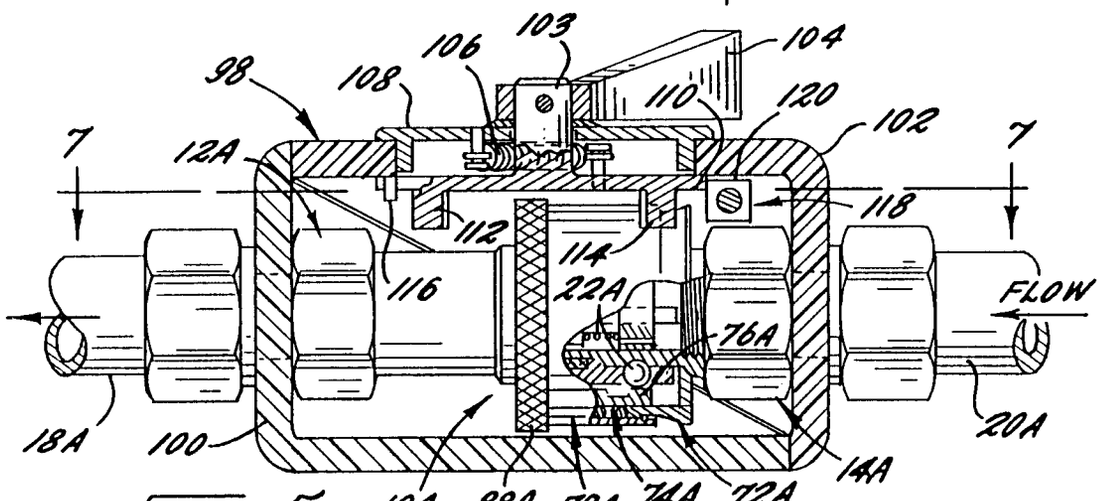

Fig. 5.

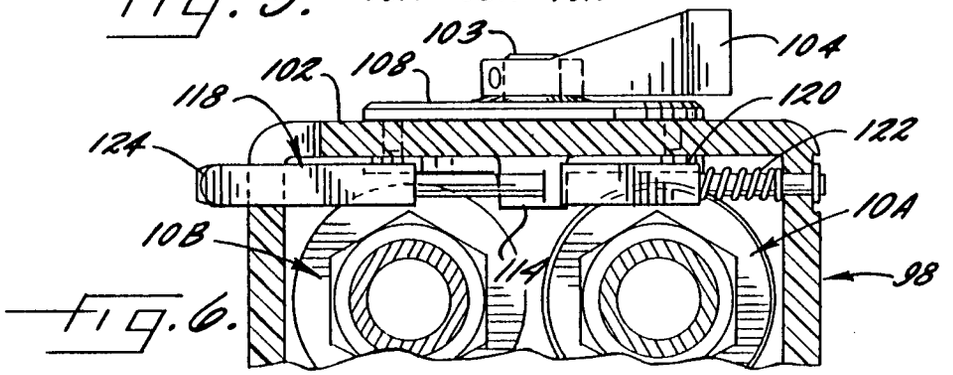

Fig. 6.

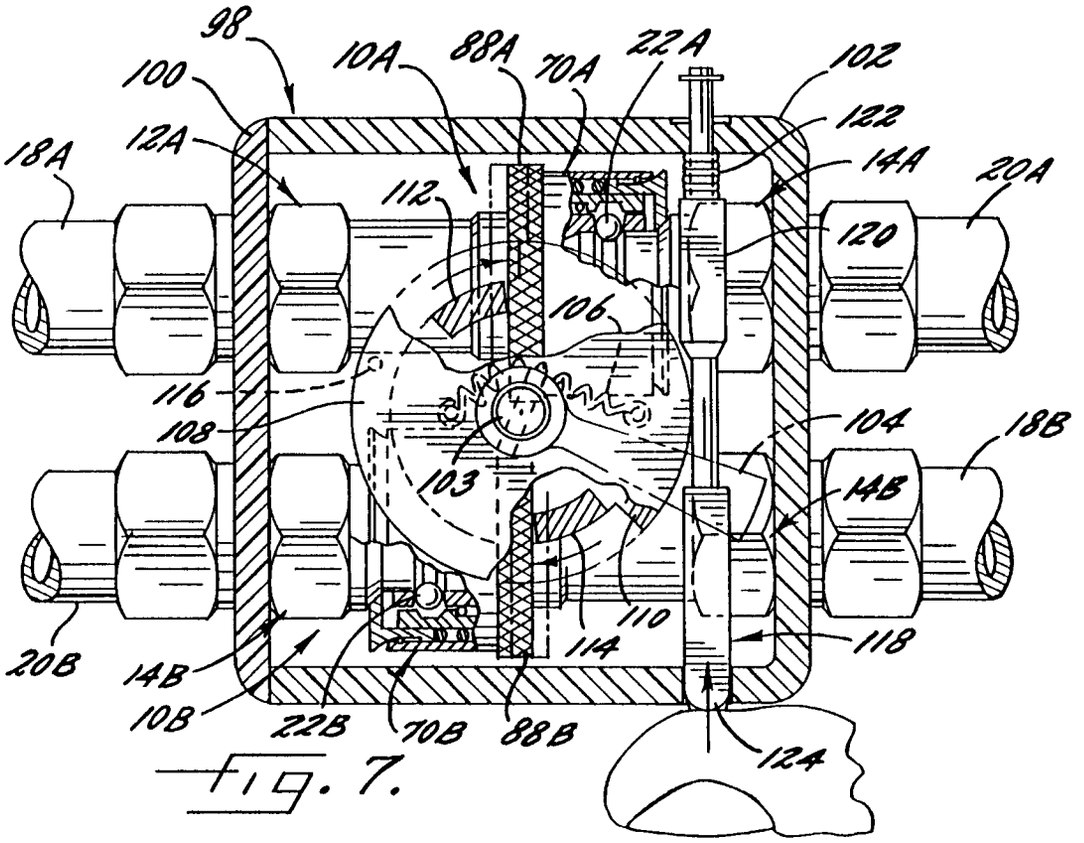

Fig. 7.

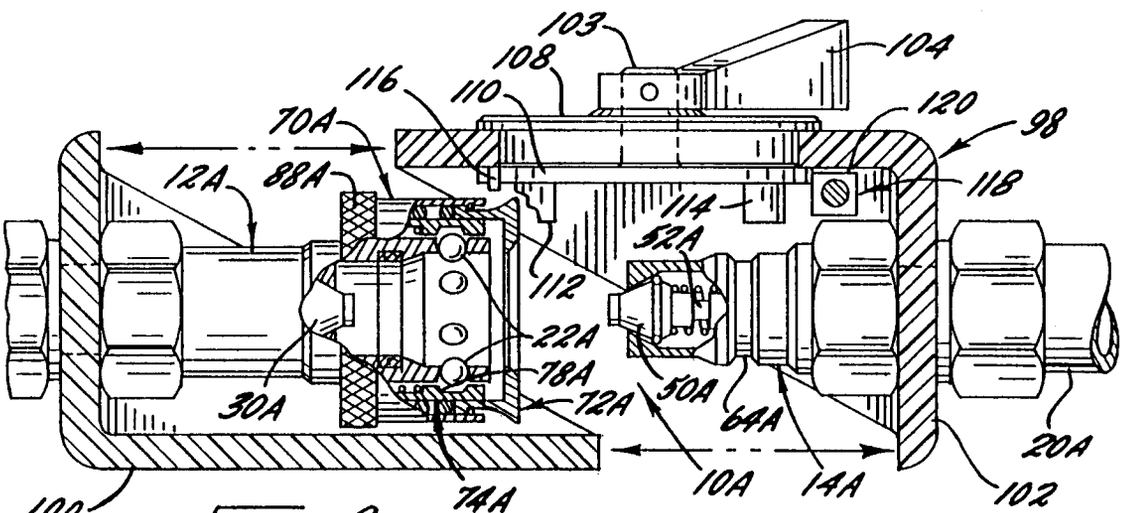

Fig. 8.

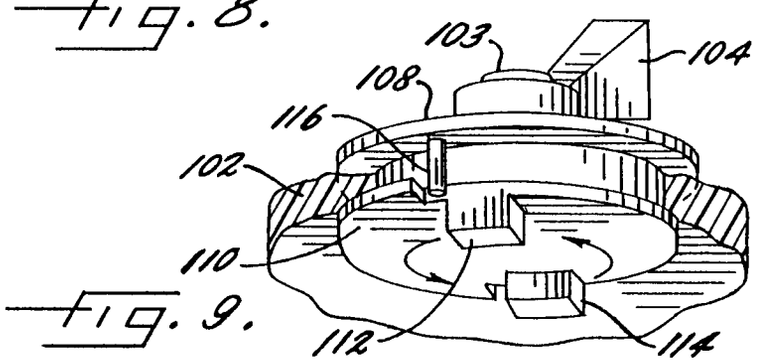

Fig. 9.